Instrumentation Scientifique de Laboratoire

ISL HOUILLON VISCOMETER BATH

INSTALLATION, OPERATION

AND

SERVICE

MANUAL

Standard Methods
ASTM D2270, ASTM D445, ASTM D341, ISO 3104, IP 71
DIN 51550, NF T60-100

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Revision Tracking

Revision index	§ concerned	Modification descriptive	Date
A		Original Issue	89/01
B	3	File format	90/04
C		V5.5 configuration	92/09
D		Revision	93/07
E		Robot interface option	93/10
F		VH2 version	95/11
G		Operator alarm	96/11
H		Complete revision	97/08
I		Setpoint values modification	99/04
J	2.4.1 Appendix I	Solvent tank 1 et 2 location Spare parts list update	02/11
K		Original issue of the file DOCV066X200 : Spare parts list Update	07/11/03
	2.2.3	Install drainage pipes	
L	§1.1	Printer using under Windows XP	05/04/04
	§ 1.1.3	Temperature range of the Houillon Viscometer	
M	§1.1.3	Temperature range of the Houillon Viscometer raised to 120°C	23/02/05
	§ 3.1.3	"Temperature Safety": updating of the setting values	

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CUSTOMER REPORT

Reserved for public relations department
N° .....
Date .....

PURPOSE

I wish to
- ☐ Report an error
- ☐ Submit a suggestion / a comment
- ☐ Get more information

In the area of ☐ Hardware ☐ Software ☐ Manual

ANALYZER ENVIRONMENT (please be complete)

• HARDWARE Type of Analyzer: .....
Serial N° : .....

Options :
- ☐ Parallel printer ☐ Graphic printer ☐ Plotter
- ☐ RS232C link ☐ VH-PC Link
- ☐ Other : .....

• SOFTWARE Version : .....

ATTACHED SHEETS

☐ Listing ☐ Diskette ☐ Drawing ☐ Text ☐ Other

PROBLEM DESCRIPTION / COMMENTS

_____

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Caution

This ISL Analyzer has been carefully designed, manufactured and inspected for quality. It has been equipped with a number of safety features.

However, the use of this Analyzer may involve the handling of solvents, chemicals, and other potentially dangerous flammable, toxic, etc.) materials. Please exercise caution when- handling these materials while operating the Analyzer.

Please:

- *read the manual*
- *wear proper protective clothing*
- *perform all suggested service procedures*
- *use care to prevent accidents.*

The manufacturer accepts no responsibility for any damage or liability arising from the use of Analyzers.

Use of Non-ISL Products and Accessories: Defects or damage that result from the use of Non-ISL branded or certified Products, Accessories, Software or other peripheral equipment are excluded from warranty.

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TABLE OF CONTENTS

1 - The system

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1.1 - General description

The system comprises:

- From 1 to 4 Viscometer baths
- A data acquisition system
- A printer (optional)
- A vacuum kit (optional)

Caution: 40 column Citizen printers do not work under Windows XP. In this case, it is advised to use a Hewlett Packard Deskjet printer.

1.1.1 - Bath

Houillon VH1 Viscometer bath: Appendix A1
Houillon VH2 Viscometer bath: Appendix A2

1.1.2 - Tank

This is a tank comprising a double glass envelope to ensure optimal thermal insulation of the system. It must be filled with oil before use.

1.1.3 - Temperature regulation system

Temperature regulation is ensured by a filament heater and/or flow of a refrigerant liquid through a tube immersed in the tank. The filament heater is the assembly of dark tubes at the rear of the tank. The refrigerating circuit is the white tube.

The temperature range of the Houillon Viscometer bath is between 20 and 120°C.

1.1.4 - Tubes and optical detection system

See appendix C1: The Houillon tube

The viscometer tubes are made of glass with a calibrated volume, which varies depending on tube type. This principle allows viscosity to be measured over a wide range of values. The calibrated volume can be found between the two black cylinders.

The detection system is made up of the two black cylinders mounted on a printed circuit. These are also known as detection cells (or cells).

1.1.5 - Cleaning system

It comprises:

- One or two solvent tank depending on model (VH1 and VH2, respectively; Refer to the Appendix A1 : VH1 Houillon bath page 5-35 and to the Appendix A2 : VH2 Houillon bath page 5-36),
- Pipes for the transport of solvent(s) to the tubes and for drainage of waste products to a single outlet at the rear of the Viscometer bath,
- Solenoid valves (SVs) which control solvent output, solvent drainage and opening to air of the tubes: there are 3 SVs for each tube on the VH1 and 4 for the VH2 (due to a second solvent output),
- Vacuum kit.

1.1.6 - Vacuum kit (see appendix B: Vacuum kit)

This option increases cleaning efficiency by creating a vacuum in the tubes. This vacuum allows most of the sample to be evacuated prior to cleaning. It also allows for better solvent flow within the tubes and thus saves time.

1.1.7 - Acquisition system

The acquisition system is a PC-compatible computer. See your 'Installation and getting started manual' supply with the ISL VH-PC software for further information.

1.2 - Principle

Determination of viscosity consists of measuring the time taken for a sample to fill a calibrated volume at a given temperature.

The sample is injected and then flows into the tube. During the flow phase, the sample comes to the temperature of the Viscometer bath. When it passes in front of the first detection cell, timing is triggered. When it passes in front of the second cell, timing is stopped. The time thus determined allows the software to calculate the viscosity using a constant called the tube constant. This constant is determined by calibration.

Viscosity is calculated using the formula V = C * t, where:

- V = viscosity
- C = tube constant
- t = time taken to fill the calibrated volume

The tubes supplied with the Houillon Viscometer bath(s) are pre-calibrated.

1.3 - Scope of use

1.3.1 - Reference standards

ASTM D 445 and its analogs:	Standard test method for kinematics viscosity of transparent and opaque liquids (+ accuracy of results)
ASTM D 341 :	Temperature-viscosity relationship
ISO 3104 and NFT 60-100:	Measurement method

1.3.2 - Manufacturer's recommendations

The Houillon viscometer can be used for any sample. The sample must not attack stainless steel, Viton®, glass, rubber or brass which are materials used in the unit and which come into contact with the sample.

2 - General system setup

Before carrying out these operations, unless otherwise mentioned, make sure that Viscometer bath and PC are switched off.

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2.1 - Installation precautions

2.1.1 - Dimensions

The dimensions given are those of the units themselves. It is preferable to allow for a larger installation area to make manipulation easier.

Unit	Width (cm)	Depth (cm)	Height (cm)	Power cords	Power rating (W)	Weight (kg)	Ac power requirements
Bath							
VH1	30	45	82	1	600	28	230 or 115 V
VH2	30	45	87	1	600	35	
PC	46	76	51	2	100	20	50/60 Hz
Vacuum kit	60	50	50	1	600	27	

The vacuum kit may be placed under the work surface on which the Houillon Viscometer bath and PC are placed.

2.2 - Installation of Viscometer bath

2.2.1 - Check hardware list

Make sure that the hardware you have received includes all items. To do this, refer to the packing list delivered with the unit. You can see an example of this list in the Spare Parts List: DOCV066X200.
Also check that the glass tank and the various components have not been damaged during transport.

2.2.2 - Installation of Viscometer bath

Make sure that the Viscometer bath is **stable and horizontal**, making use of the adjustable foot. The drainage outlet (at rear of Viscometer bath: see appendix A3) must be connected to a reservoir in order to collect the drained liquids. The vacuum kit can replace this reservoir in order to reduce cleaning time.

2.2.3 - Installation of tubes

The detection cells are already mounted on the tubes supplied with the Houillon Viscometer bath. In the event that these cells are not pre-mounted, they must be mounted before installing the tubes (cf. section 3.2.2 - Installation of a detection cell page 3-24). The tubes supplied with the Houillon Viscometer bath with pre-mounted cells are already calibrated. They must be installed from left to right, going from low to high constants.

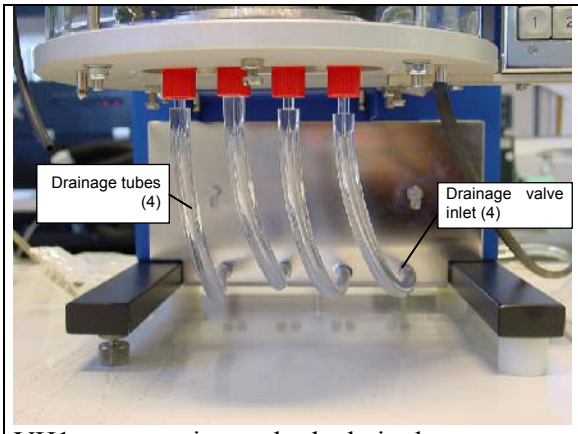
The tube cables must be connected as follows:
- Tube 1: Upper left
- Tube 2: Lower left
- Tube 3: Upper right
- Tube 4: Lower right

You may refer to appendix C3 for tube installation.

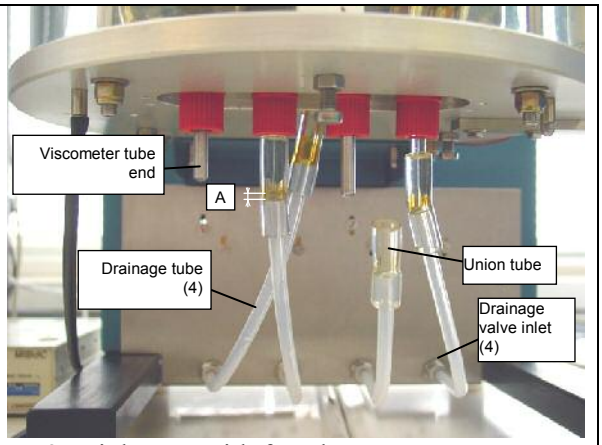
Method:

Check the tank contains no oil.

1. Place the viscometer tube inside the tank and insert it in the hole at the bottom
2. Install the valve clamp under the tank:
   - Place the seal in the red plug, the white part facing down
   - Screw down the valve clamp
3. Repeat steps 1 and 2 for each tube (4 in all)
4. Connect the drainage pipes to the viscometer tubes end (under the bath) and to the drainage solenoid valve inlet (note: on the VH2, install an union pipe):



VH1 – connection on barbed nipple

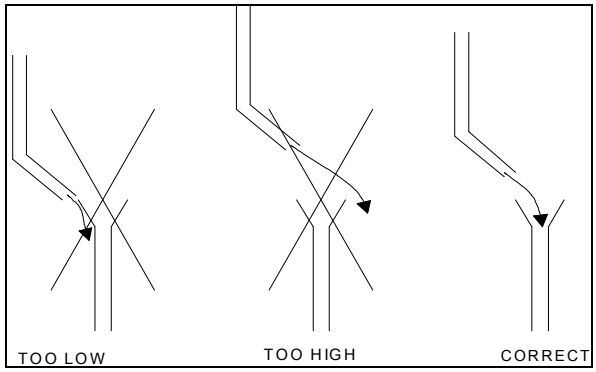


VH2 – tightness with ferrule:

- Insert the union pipe (M00657) into the drainage pipe (M00664)
- Connect the drainage pipe (M00664) to the solenoid valve inlet (replace the ferrule) and tighten the nut of the connector
- Connect the union pipe (M00657) to the viscometer tube bringing at the most the draining pipe end (M00664) near the viscometer tube end: the distance A must be minimal.

5. Connect the detection cells to the Viscometer bath
6. Install the centering plate at the top of the Viscometer bath and tighten the two knobs (see appendix C4)
7. Install the water-tight seal around the tubes (split black seal)
8. Put the securing plate in place an tighten the 5 screws

   Note: The height of the solvent pipes must be adjusted to avoid solvent flow outside of the tube



2.2.4 - Vacuum kit

The connections, which must be made, are indicated in appendix B.

2.3 - Filling bath

2.3.1 - Oil type, volume

Silicon oil of viscosity 100 cSt at 25°C must be used. The fill volume is about 5 liters.

Oil references:

- Rhodorsil oil 47V 100 25 kg
- P/N : see the Spare Parts List, DOCV066X200
- Method

1. Install the tubes
2. Screw down the valve clamps
3. Do not install the centering or securing plates nor the flat split seal
4. Pour the oil into the opening on top of the glass bath until the fill line corresponding to the temperature at which the glass bath is to be operated has been reached
5. Use a metal to top up the level using the filling hole (appendix C4; ref.2)

The oil fill level depending on operation temperature is indicated on the tank by printed marks.
These marks are defined at 25°C for the Rhodorsil oil referred to above, the tubes already having been installed.

Example: For operation at 100°C, fill the tank with oil up to mark 3.

Operation temperature (°C)	Fill line (cells installed)
40	WL
60	1
80	2
100	3

2.4 - Solvents

2.4.1 - Volume, type

The volume of each solvent tank is 5 liters, regardless of model. It is situated at the top of the Viscometer bath.
In the case of VH2 (2 tanks), the solvent tank 1 is located on the left when looking from the front of the Analyzer and the solvent tank 2 on the right (see Appendix A1 page 5-35 and Appendix A2 page 5-36).

For information on which solvent to use, refer to chapter 3.4.2 - Recommended solvents page 3-26.

2.4.2 - Method

- Check that the purge valve is closed
- Pour in the solvent using the hole situated on top of the tank

2.5 - Connection to the PC

To connect baths to a PC computer, please see your 'Installation and getting started manual' supplied with the ISL VH-PC software.

2.6 - Bath-PC link

When you are sure that the Viscometer bath and the PC are correctly connected, switch the Viscometer bath on. You should observe the following :

- The main switch should light up
- Bath stirrer should start
- The fan at the rear of the Viscometer bath should operate
- Bath temperature should be displayed
- The heater lamp should light up or flash

If the Viscometer bath operates correctly, switch on the PC and start the ISL VH-PC software. The connection is good if none of the measurement lights on the Viscometer bath flash after about 20 seconds.

During startup of the real time software, from the main program menu, no error should be displayed.

If a bath number is displayed in red and the case ‘Responding’ is not checked :

- Check connections between the PC and the Viscometer bath(s)
- Check that Viscometer bath declaration has been carried out

2.7 - Installation of an additional Viscometer bath

To install an additional Viscometer bath, its number must be configured using the jumpers, as indicated in appendix E. After this, simply carry out the same procedure as used for the installation of the first Viscometer bath.

Procedure to follow (*steps to be carried out with both Viscometer bath and PC switched off):

- Configuration of Viscometer bath number*
- Installation of tubes*
- Fill Viscometer bath with oil*
- Fill solvent reservoir*
- Connection to PC*
- Switch on Viscometer bath
- Declaration of new number of Viscometer baths
- Declaration of new Viscometer bath **"In Operation"**
- Configuration of tube constants
- Temperature set point
- Temperature correction

3 - Operation of ISL Viscometer bath

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3.1 - Bath temperature

3.1.1 - Setpoint and correction from PC

Bath temperature is determined by a set point entered on the PC. It may be necessary to correct this set point after verification of the actual Viscometer bath temperature using a thermometer accurate to within one hundredth of a degree (ref ISL : see the Spare Parts List, DOCV066X200)
These operations are operated from the PC software. For further information, see the ISL VH-PC software On line help.

3.1.2 - Heating phase and regulation

The two lights (LED) above the Viscometer bath On/Off button are the two heater indicators:

- Top light: regulation
- Bottom light: rapid heat

- During the heating phase, both indicator lights are illuminated
- During the regulation phase:
  - The regulation indicator light flashes
  - The rapid heat indicator light flashes if the regulation heater is not sufficient for the temperature asked and complementary heating is needed (e.g., if the Viscometer bath is at 100°C)

3.1.3 - Overheat safety

On overheat safety has been installed on the Viscometer bath. It is not visible from the outside as it is situated in the block above the tank (see appendix D).

The safety mechanism consists of a thermostat, which allows a maximum temperature to be set for the Viscometer bath. If this maximum temperature is reached, the heater circuit is cut by a relay. When the temperature returns to a value below this safety limit, the heater circuit is no longer cut by the relay and regulation starts again.

The overheat safety can be set between 20 and 140°C. The factory setting is 130°C.

3.2 - The tubes

3.2.1 - Choosing the right tube

The right tube to use depends on the estimated viscosity of the sample to be tested. To do this, you can refer to the table in appendix F or follow the procedure below:

- Assuming V is the estimated viscosity of the sample for test
- And C is the tube constant

The tube should then be chosen so that: $V / 200 < C < V / 30$

30 and 200 are time values in seconds. They correspond to the min. and max. acceptable flow times that a sample can take to fill the calibrated volume of the tube.

3.2.2 - Installation of a detection cell

This operation must be carried out before installing tubes, which have been ordered in addition to those supplied with the Houillon Viscometer bath.

The cells already installed on a tube to be replaced can be used. The cells must be cleaned using a solvent and the Viton® seals must be changed (ref. ISL: see the Spare Parts List, DOCV066X200) before reinstalling the cells on new tubes.
You may refer to appendix C2 for the reinstallation of a cell.

- Precautions:

    - Clean the cell using a solvent which is neutral with respect to the Viton® **(never use acetone or toluene)**
    - Dry the cell before installing on the tube
    - Make sure that the seals are correctly placed on each side of the detection cells (see appendix C2)
    - Install the cell as described in appendix C1

After installing the cell and installing the tube in the Viscometer bath, it is imperative that the tube be calibrated.

3.2.3 - Changing a tube

It is necessary to change a tube when it is damaged or when it is not suitable for testing a given sample.

- METHOD:

    - Remove drainage pipes
    - Place a recipient under the tubes
    - Disconnect the cell connector plug
    - Remove the securing plates from the top of the tank
    - Remove the split seal
    - Remove the centering plate
    - If the bath is at a too high temperature (>60°C), protect your hands with gloves
    - Loosen the valve clamp so that the tubes can be moved
    - Place the plug (solid metal cylinder) under the tube to be changed (see appendix C3)
    - Push the tube from underneath with the plug
    - Leave the plug in the place of the tube
    - Take the tube out of the glass bath and drain
    - Install a new detection cell on the new tube (the one on the old tube may be used)

To install the new tube, carry out the above procedure in reverse order.

Remember to adjust the solvent supply tube with respect to the new tube.
The newly installed tube must be calibrated.

3.2.4 - Tube calibration

Tube calibration is carried out from a special menu within the program and is performed by the operator like a series of normal measurements.
These operations are performed from the PC software. For further information see the ISL VH-PC software on line help.

3.3 - Performing a measurement

3.3.1 - Starting measurement

- Preferably use a micro-pipette
- The sample volumes recommended as a function of the tube constant are indicated in a table in appendix F.

Note : Those may be introduced in the ISL VH-PC software memory.

- Injection is performed via the tube flange

- Precautions:

  - Do not use the same syringe tip cap for two different samples, otherwise purge the tip with the new sample
  - Make sure that the sample is filled in the middle of the tube
  - Make sure that the filling conditions are fulfilled (see appendix C1)

3.3.2 - Measurement status

Measurement status is followed using the gray panel next to the tank, which comprises 4 buttons and 8 indicator lights (see appendix A1 page 5-35 or A2 page 5-36).

3.3.3 - Buttons

To start a measurement, use the buttons on the gray panel. Press the button corresponding to the tube once the injection can be carried out to indicate to the Viscometer bath that the measurement has been started (prior to this, the operator can enter the sample number in the ISL VH-PC software.
The buttons are numbered from left to right 1 to 4 respectively.

3.3.4 - Indicator lights

For each button there are two corresponding indicator lights situated above. The upper light is the measurement indicator and the lower light is the counter indicator.

The counter indicator is normally only lit when the sample meniscus is between the two optical detection cells.

For the measurement indicator light, the corresponding measurement status is indicated in the table below:

Indicator light status	Bath status	What to do
Lit	Viscosity measurement in progress	Wait for the end of the measurement and cleaning sequence
Flashing	Cleaning postponed or underway	Wait for the end of the cleaning sequence
Out	At rest	You may start a measurement

• **Special case**: When the Viscometer bath is first switched on, the measurement indicator lights flash for a few seconds. This is normal: it corresponds to a servo-phase necessary for correct operation of the detection system.

3.4 - Tube cleaning

3.4.1 - Principle and operation

The principle consists of sucking away the sample residue left in the tube. A solvent is then used to remove any traces of the sample on the tube walls. The solvent is then removed. This operation is repeated over several cycles, the number of which depends on the sample and the tube constant.

For the VH2 unit, two solvents may be used: one for cleaning followed by another for drying.

The modification of these constants is performed from the PC software. For further information, see the ISL VH-PC software on line help.

3.4.2 - Recommended solvents

The solvent used must be miscible with the sample and should have a boiling point slightly higher than the Viscometer bath temperature:

- Bath at 40°C: The boiling point should be between 40 and 60°C
- Bath at 100°C: The boiling point should be between 100 and 120°C

The solvent must not attack glass, stainless steel, Viton® or rubber.

The solvents, which may be used, will depend on the authorizations granted to your laboratory.

Some suggested solvents are as follows:

40°C	100°C
Trichloroethylene Hexane etc.	Tetrachloroethylene Ether Toluene etc.

For the VH2 unit, acetone should be used at low temperatures only and only as a drying solvent to be used after the first cleaning solvent.

3.4.3 - Start

The tube cleaning sequence is started automatically after each measurement. It can also be manually started at any point during the measurement (if the measurement has been intentionally stopped, for example). It is therefore necessary to start by defining the cleaning constants when you received the bath for the first time or when you replace a tube before starting any measurements.

When delivered, the Viscometer bath has predefined constants, which can be modified by the operator if desired.

3.4.4 - Solvent flow

The solvent flow must be sufficient to clean the whole tube. This means that the solvent must completely fill the tube flange to be of any use. To fulfill this condition, the time for which the solvent flows and the flow rate are adjusted using the appropriate screws.

Note : The VH2 is supplied with solvent flow adjusting device for each of the 2 solvents.

3.4.5 - Tube maintenance

To ensure good operation, it is necessary to regularly check that the tubes are not damaged and are clean. To do this, reference oils adapted to the tube to be checked are used. A kit of these oils is supplied with the Houillon Viscometer bath.

These oils are used like ordinary samples. Viscosity measurements are carried out on these oils using the tube to be checked. If the result obtained differs from the theoretical viscosity indicated on the certificate, it is necessary to carry out a more vigorous cleaning of the tube in question. To do this, **sulfochromic** acid is used.

The frequency with which the tubes should be checked using reference oils depends on the frequency with which the tubes are used for measurements: This is determined as a function of the operational workload of the tubes and in accordance with your Quality department.

Make sure that no acid comes into contact with the seal or the bath oil. If acid does accidentally come into contact with the seal or the bath oil, change the oil as soon as possible to avoid deterioration of the detection cells.
Remove the acid using a glass pipette avoiding any contact with the skin.

- METHOD:
    1. **Remove the drainage pipes** and place them aside to avoid any acid spills
    2. Place a glass recipient under the tube to be cleaned to collect the acid used
    3. Take 1 to 2 ml of acid using a glass pipette and place in the top part of the tube
    4. Allow the acid to run down the tube and wait until all the acid has been collected in the recipient
    5. If some deposits remain, repeat steps 3 and 4
    6. Rinse the tube well using water only
    7. Reconnect the drainage pipes and carry out a normal cleaning cycle on the tube
    8. Recalibrate the tube

Optimal acid cleaning is obtained at 100°C.

3.5 - Purge

3.5.1 - Oil

CAUTION : Before any manipulation, switch off the Viscometer bath and allow it to cool down to an acceptable temperature (<60°C).

- Method 1:
    1. Disconnect the drainage pipes and remove the securing plates and the centering plates
    2. Place a reservoir with a capacity of at least 5 liters under the tubes to collect the old oil
    3. Remove the red part of the valve clamp (the seal may be left on the tube or in the plug)
    4. Leave the oil to drain into the reservoir: if the oil does not drain, gently slide the tube
    5. Rinse the tank, tubes and the valve clamp with a solvent
    6. Retighten the valve clamp
    7. Leave the tank to dry

- Method 2:
    1. Disconnect the drainage pipes
    2. Connect a drainage pipe to the purge plug which runs to a reservoir of at least 5 liters (the purge plug is a hollow metallic cylinder)
    3. Proceed as for changing the tube by replacing the normal plug by a purge plug:
        - Remove the cover and the seal on the top of the tank
        - Replace one of the tubes by the purge plug onto which the valve clamp is then tightened
    4. Rinse the tank and the tubes with a solvent
    5. Reinstall the tube
    6. Leave the tank to dry

The tank is now empty and need only be refilled with oil. See chapter 2.3 "Filling" for instructions on how to do this.

3.5.2 - Solvent(s)

- Connect a pipe to the tank drainage outlet
- Place a 5-litre recipient under the pipe
- Gently open the valve
- Incline the Viscometer bath so as to drain a maximum amount of solvent (attention: the unit is heavy)

Before filling the solvent tank again, leave it to dry.

4 - Carrying out a measurement

(summary of method)

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4.1 - On the PC software

- Select a tube (by moving cursor to the corresponding field)
- Optional: Identify the sample (15 characters maximum)
- Optional: Refine selections (average, viscosity index)

4.2 - On the bath

- Take sample using micropipette (in accordance with recommended volumes)
- Inject the sample into the tube
- Start measurement by pressing the corresponding gray button
- Wait for the sample to flow
- Check that the measurement has been performed correctly (sample level in the reservoir)
- Note the result
- Leave the cleaning sequence to proceed
- Allow the tube to reach the bath temperature (about 5 minutes) before performing a new measurement

If reproducibility for a given sample is not good, modify the cleaning constants:

- **Increase the number of cycles**
- **Increase aspiration time before and after passage of solvent**

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5 - Appendices

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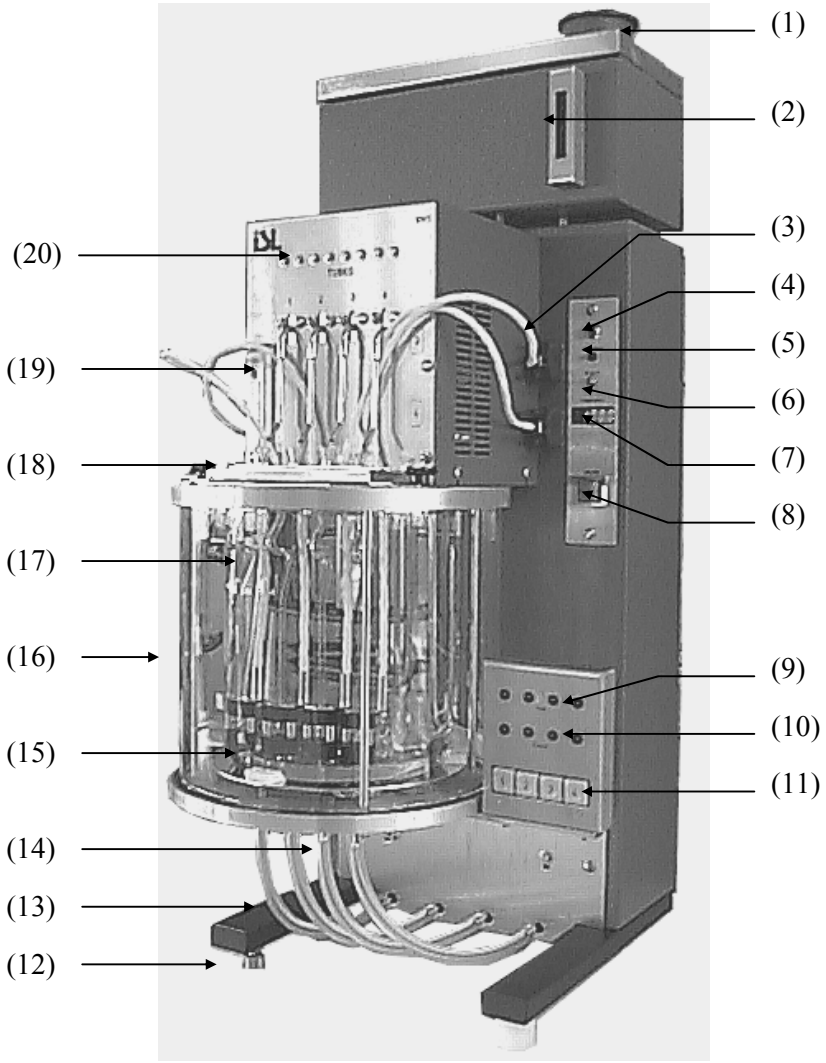
APPENDIX A1 : VH1 Houillon bath

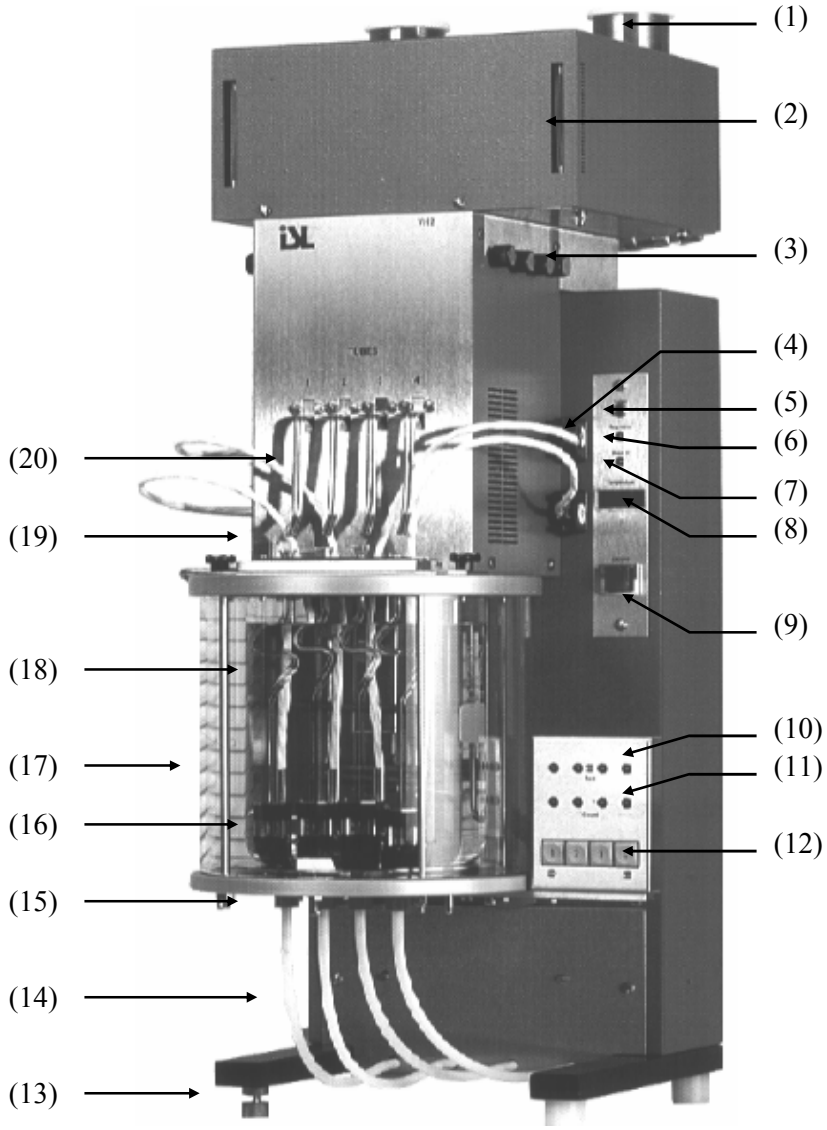


LEGEND :

(1)	Solvent inlet	(11)	Measurement button
(2)	Solvent level indicator	(12)	Adjusting foot
(3)	Detection cell plug	(13)	Outlet draining pipe
(4)	Temperature security indicator light	(14)	Valve clamp
(5)	Regulation indicator light	(15)	Detection cell
(6)	Rapid heating indicator light	(16)	Glass bath
(7)	Temperature display	(17)	Measurement tube
(8)	On/Off switch	(18)	Temperature checking aperture
(9)	Measurement indicator light	(19)	Solvent filling pipe
(10)	Counting indicator light	(20)	Solvent flow adjusting screws

On VH1, solvent flow adjustment is performed by 2 screws ref.20 (located upside of the solvent filling pipe)

APPENDIX A2 : VH2 Houillon bath

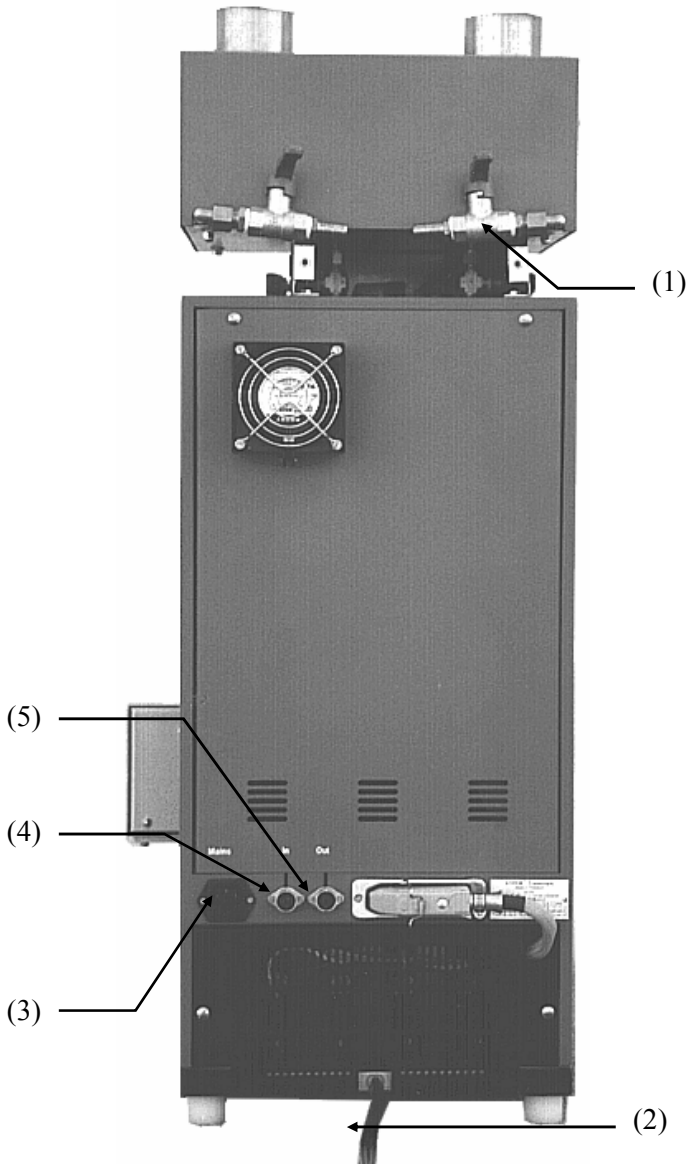


LEGEND :

(1) Solvent inlet (solvent tank 1 on the left; solvent tank 2 on the right)
(2) Solvent level indicator
(3) Solvent flow adjustment
(4) Detection cell plug
(5) Temperature security indicator light
(6) Regulation indicator light
(7) Rapid heating indicator light
(8) Temperature display
(9) On/Off switch
(10) Measurement indicator light
(11) Counting indicator light
(12) Measurement button
(13) Adjusting foot
(14) Outlet draining pipe
(15) Valve clamp
(16) Detection cell
(17) Glass bath
(18) Measurement tube
(19) Temperature checking aperture
(20) Solvent filling pipe

On VH2, solvent flow adjustment is performed by an adjusting knob ref.3 on each side of the Analyzer.

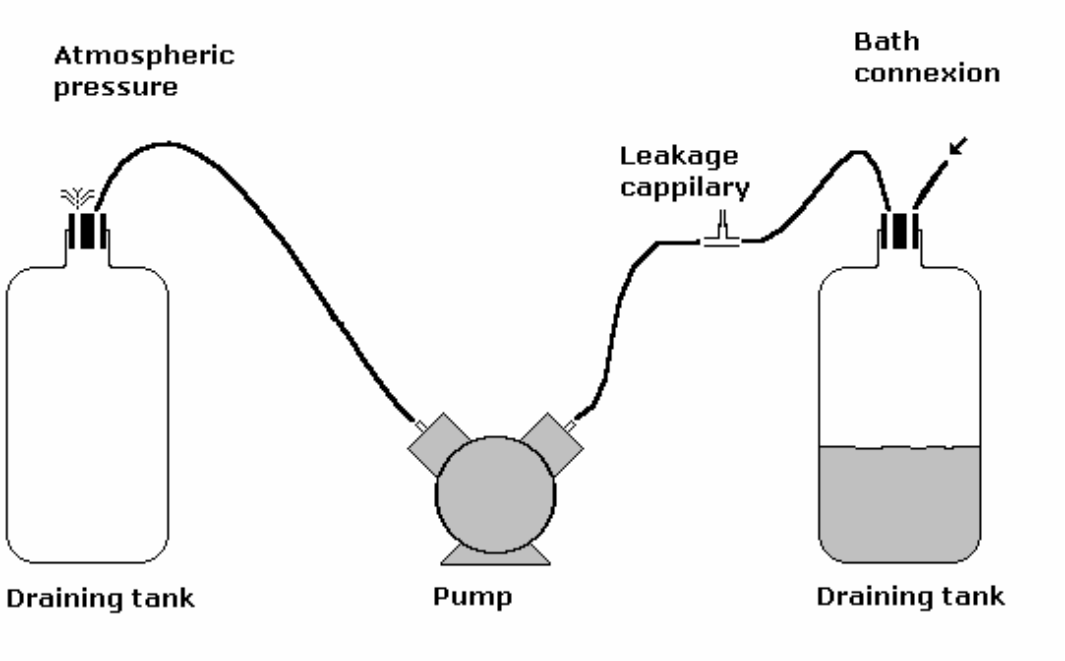
APPENDIX A3 : Houillon bath – rear view



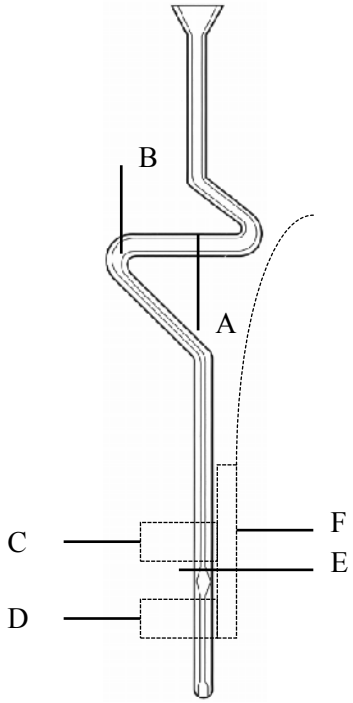
LEGEND:

(1) Solvent draining outlet (1 on VH1, 2 on VH2)
(2) Main draining pipe
(3) Bath power supply plug
(4) Bath PC connection: 'IN' plug
(5) Bath PC connection: 'OUT' plug

APPENDIX B : Vacuum kit



APPENDIX C1 : Houillon tube



A - B	:	Measurement tube tank
C - D	:	Calibrated volume - Measurement zone
E	:	Bulb
F	:	Detection cell

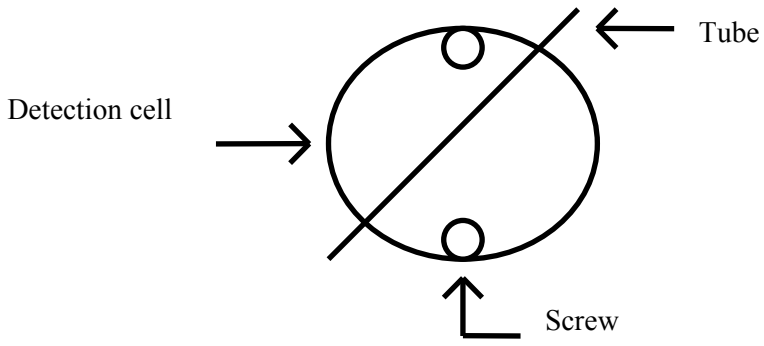
TUBE FILLING VOLUME FOR A MEASUREMENT :

The filling volume is OK when:
At the beginning of a measurement:
- Sample upper meniscus is on A
- Sample lower meniscus is on C

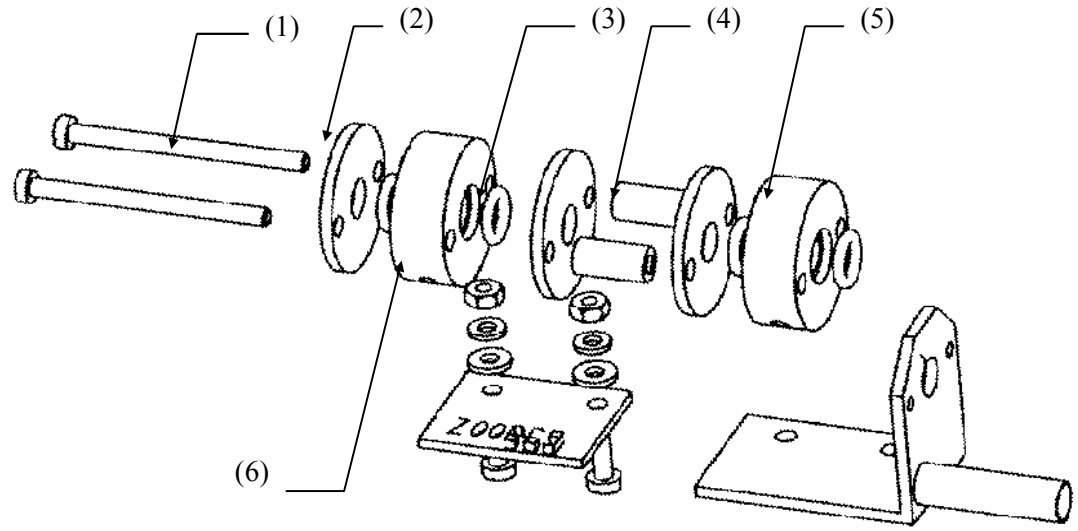
At the end of a measurement:
- Sample upper meniscus is on B
- Sample lower meniscus is on D

DETECTION CELL INSTALLATION :

Detection cell F must be mounted in order that E bubble has to be between the 2 black cylinders. Those cylinders must be on C and D
Located the tube as the drawing here under :



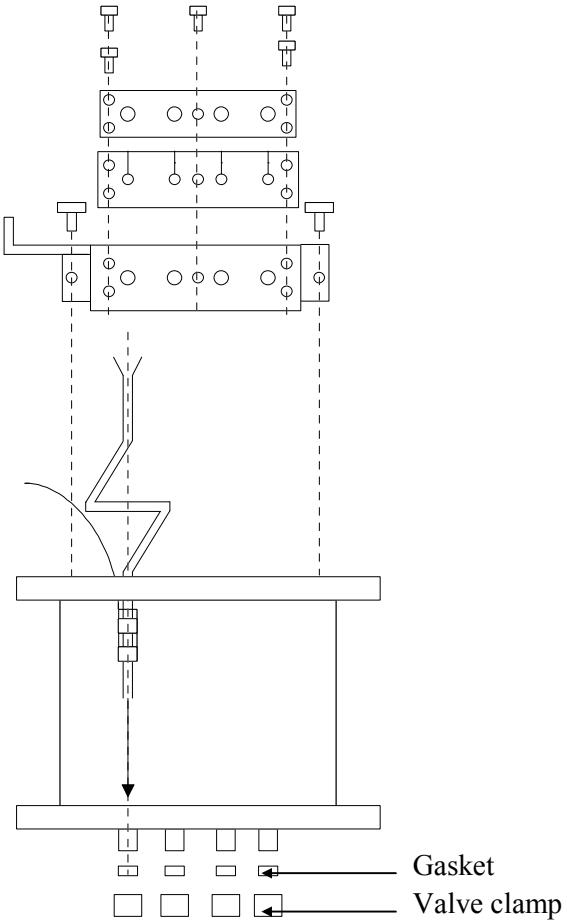
APPENDIX C2 : Houillon detection cell



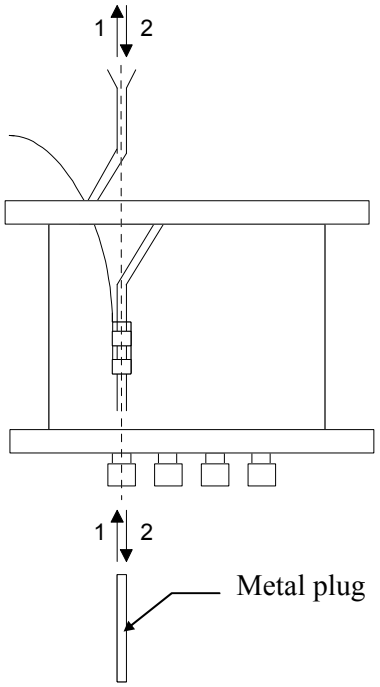
LEGEND :

(1) Cell maintaining screw
(2) Washer maintaining gasket
(3) O Ring Viton® gasket
(4) Spacer
(5) High optical detection cell ⇒ Start measurement
(6) Low optical detection cell ⇒ Stop measurement

APPENDIX C3 : Installation and replacement of a Houillon tube



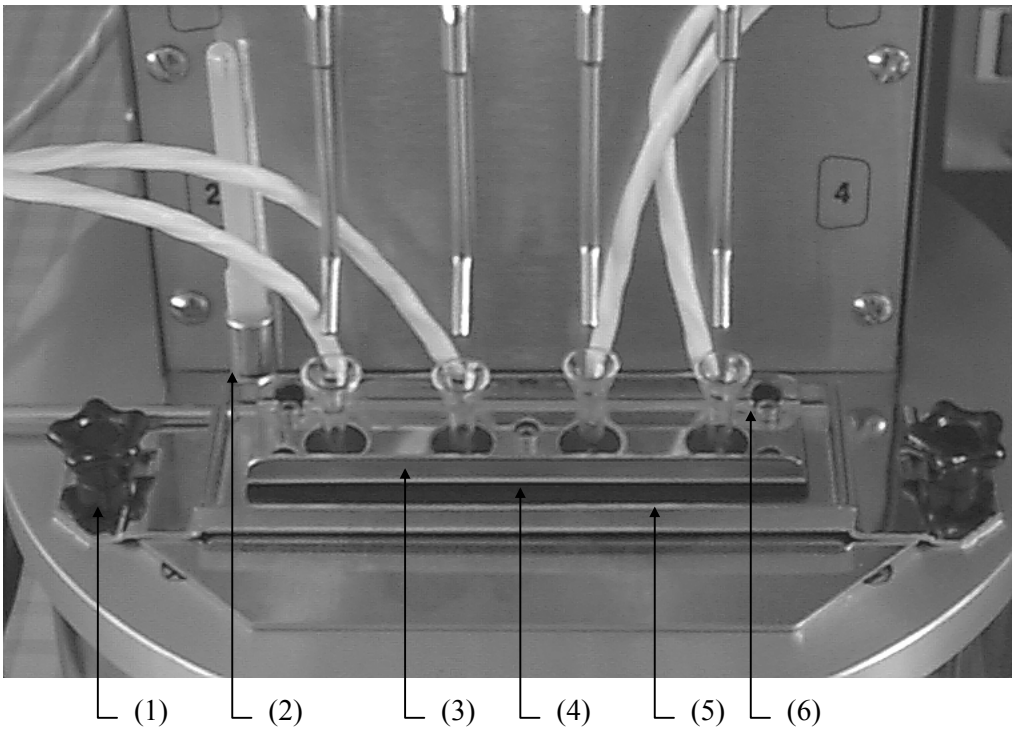
TUBE INSTALLATION ON A BATH WITHOUT OIL



TUBE REPLACEMENT IN BATH OIL FILLED :

- 1 : Removing of the older tube (Metal plug push the tube)
- 2 : New tube installation (New tube push the metal plug)

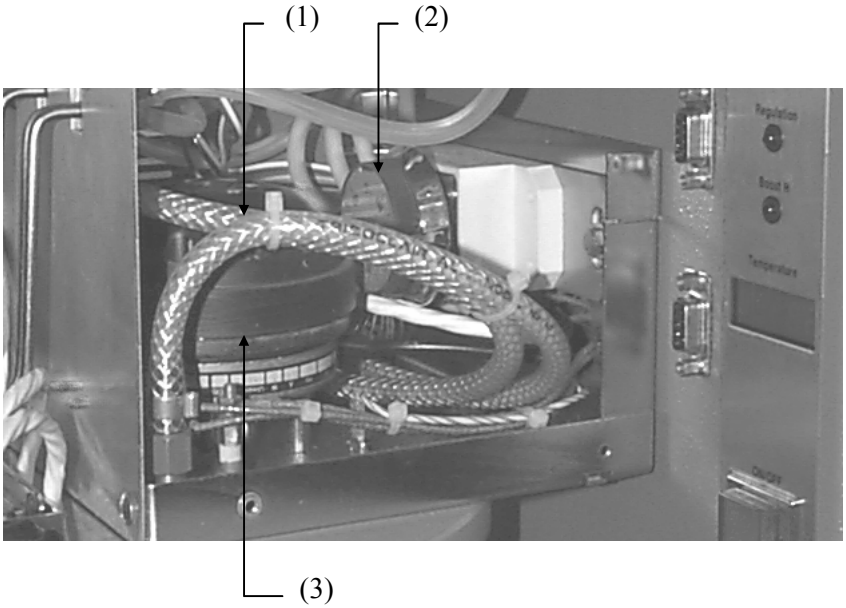
APPENDIX C4 : Installed tubes



LEGEND :

(1) Locking device
(2) Temperature checking aperture and/or filling aperture
(3) Locking plate
(4) Splitting gasket
(5) Centering plate
(6) Locking screw

APPENDIX D : Temperature safety thermostat



LEGEND :

(1) Cooling circuit
(2) Temperature safety bulb
(3) Bath stirring motor

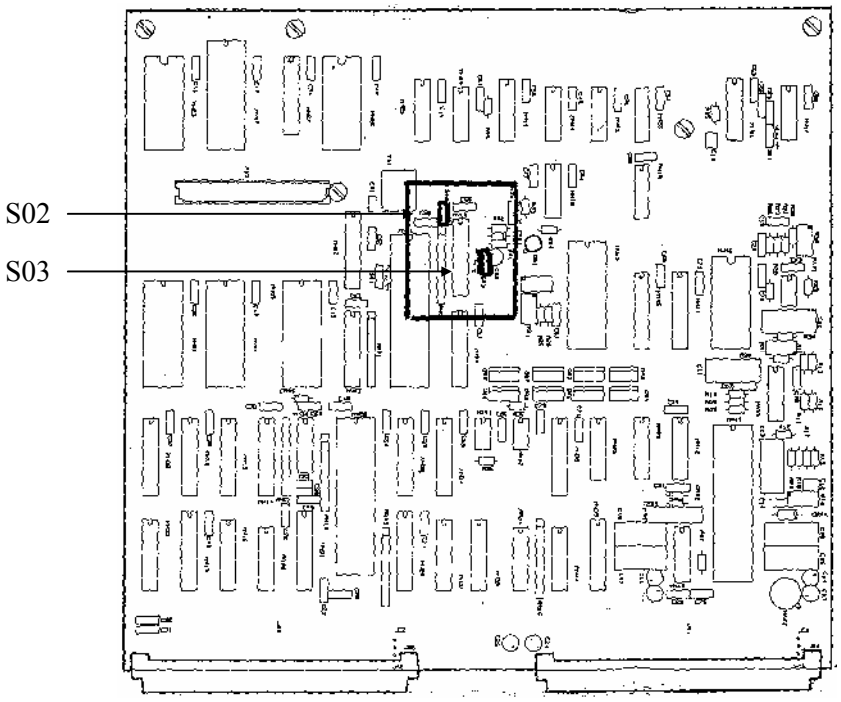
Cooling circuit is connected to 2 metallic plug on the left of the bath, under the detection cell plug.

APPENDIX E : Houillon bath number configuration

Note: These operations have to be done when the Houillon bath is **switched off and unplugged**.

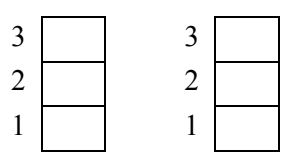
When you received your Houillon bath, it is configured as bath #1. If you already owned one or several baths, you have to change the configuration of your bath to use it.

Example: If you already owned one Houillon bath, you need to change the configuration of the received bath as bath #2.



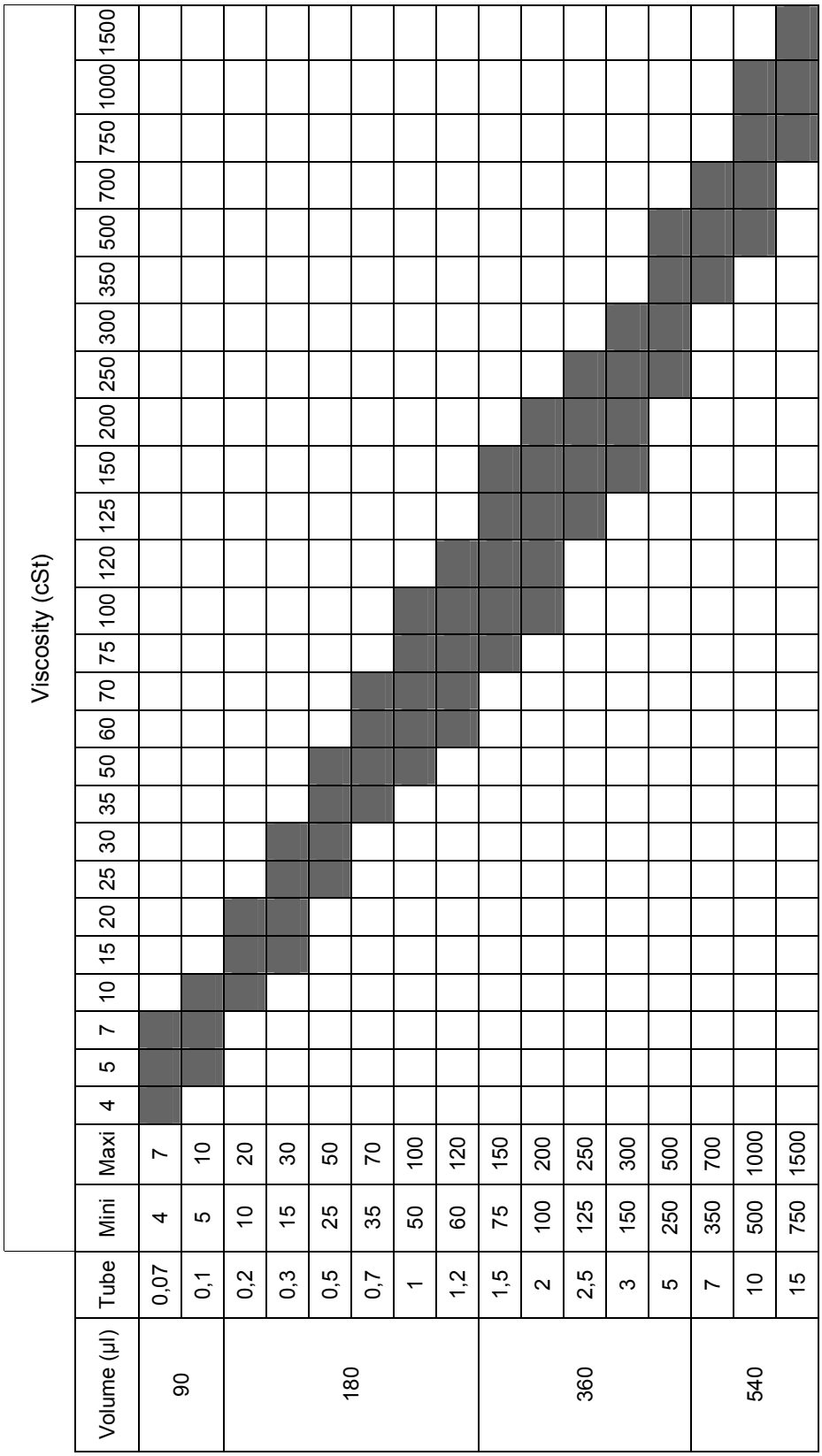
- Unplugged the main cable.
- Remove the bath rear panel
- Notice the jumper as mentioned on the here-above drawing.
- Set up the jumper as mentioned on the chart here-under:

S02	S03	Bath #
1-2	1-2	1
2-3	1-2	2
1-2	2-3	3
2-3	2-3	4



After, you have to install the Houillon bath. You have also to declare the bath ‘connected and running’ in the VH Windows software and to fill it with oil before power it on.

APPENDIX F : Allowed viscosity with different tube constant



Note: For an optimum measurement, it is advised to be in the middle of thee tube useful range. This chart is for new and use oil.

APPENDIX G : Frequently asked questions

The measuring led is switching on:

- The tube is cleaning: The led will switch off at the end of the cleaning.

- The tube is dirty or moist :

➔ Check the cleaning constants
- Increase the number of solvent cleaning cycles
- Increase the drying period after the last solvent
- Start a cleaning cycle

➔ If the tube is plugged: Start a sulfochromic acid cleaning :
- **Disconnect the draining pipe**.
- Put the acid through the capillary.
- Rinse only with water.
- Connect the pipe.
- Start a cleaning cycle.

➔ Check the detection cell:
- Change the detection cell plug with one, which is running.
- The tested cell is running: The processor has a problem.

➔ Detector checking :
- Remove the bath tube and disassemble the detection cell
- Clean all pieces with alcohol
- Put the 4 waterproofness washers and assemble the cell on the tube
- Are the reception values in the Service Software near 1677?
  - Yes : Put the tube in the bath calibrate it.
  - No : Change the detection cell (Ref: see the Spare Parts List, DOCV066X200)

➔ Processor checking: Check the values for each tube in the Service Software. These values are:
1677 for reception
2077 for emission.

If you can not modify those values, you must program the bath again:
- Switch off the bath
- Keep the 4 keys pressed (1, 2, 3, 4) and switch on the bath
- Switch off the bath
- Switch on the bath normally.

The default values are automatically programmed.

CAUTION : The temperature correction value is 0. You must correct if before measuring.

The test light is flashing when no measuring or cleaning is started.

- Check the control system :

- Check if there is a trouble with the optical control system or with detection cell:
➔ Cross the tested detection cell with another:
  - The tested cell works and not the other : Trouble occurred the optical control system
  - The tested cell does not work : Trouble occurred from the cell.

- If the trouble occurred from the detection cell :
➔ Check the cell's waterproofness:
  - Disassemble the cell, clean it completely and dry it
  - Change the Viton® gaskets (reference: see the Spare Parts List, DOCV066X200).
  - Assemble the cell on a tube without assembling the whole bath
  - Check the optical control system:
    * If it not correct : Change the detection cell
    * If it is correct : - Replace the whole in the oil bath
      - Check the optic control system
      * If it is not correct : - Change the Viton® gasket.
        - Check again
      * If it is correct : The system is OK.

The link between the bath and the PC seems to be interrupted

- Check if the connections are corrects :
  - The link plugs must be well connected.
  - The terminator must be in place on the last bath.

- Check that RS 232 / Current loop converter is working :
  - The 2 'Tx / Rx' leds must be flashing.

- Check the software configuration :
  * <u>On the PC software</u> :
    - Baths in use are declared « Connected »
    - Baths in use are declared « In use »
    - Bath numbers must match the PC software set up.
  * <u>On the bath (see Appendix E)</u>
    - The bath number must be unique.

The solvent does not pour during the cleaning cycle

- Check if there is enough solvent in the tank.

- Check if the solvent open time is different from 0.

- Check the inlet solvent solenoid valve.

The sample flow out in the tube without pressing the measurement starting button.

- Check if the tube fit the sample viscosity (see Appendix F).
  - If the tube is OK, check the open-air solenoid valve.
  - If not change for a more convenient tube.

The sample does not flow out in the tube when the measurement starting button is pressed

- Check if the tube is not plugged :
  - If it is plugged: clean it with the sulfochromic acid
- Check the open-air solenoid valve

The solvent solenoid valve does not work. There is no noise.

- Check the ISL VH-PC Software configuration 'Cleaning' and 'Number of cleaning during a measurement' ...

- Check the other solenoid valves :
  - None are working: contact ISL Service Department.
  - Only one is not working: check its different parts.

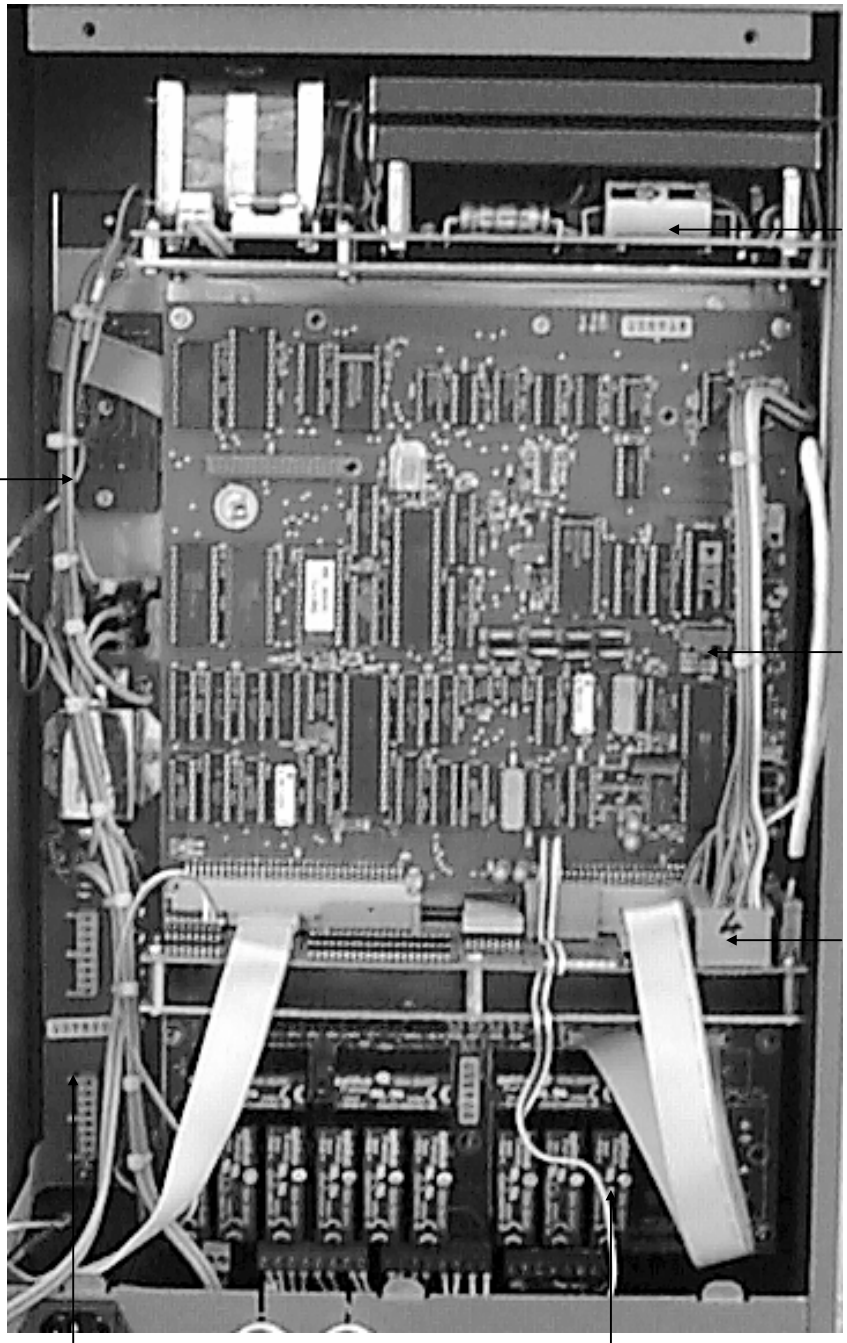
- Check the different parts of the solenoid valve :
  * Check the connector:
    - Change the connector with a good one.
    - The tested solenoid valve works: Change the connector.

  * Check the solenoid:
    - Change the solenoid with a good one.
    - The tested solenoid valve works: change the solenoid.

  * Check the brass part of the solenoid valve:
    - Disassemble this part.
    - Check if there is corrosion or if it is plugged.
    - Reassemble the part.

- If the problem does not come from the solenoid valve, you must check the electronic control :
  - Identify the static relay of the tested solenoid valve.
  - Check if the LED above the relay is switching on :
    * LED is switching off: change the static relay.
    * LED is switching on: check the Static Relay Board and Cell Detection Board circuits.

APPENDIX H : Electronic boards in Houillon bath



There are also :
- Temperature sensor board
- Keyboard board